ABSTRACT

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Study Program	:	*Electrical Engineering*
Title	:	*Photoplethysmography Signal Extraction Using Time-Frequency Analysis on Blood Sugar Measurement*

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by blood sugar levels that exceed normal limits. Blood sugar testing is generally done invasively. However, this method causes pain and discomfort when used. The Photoplethysmography (PPG) method for non-invasive blood sugar measurement offers a more convenient solution than the conventional method using a glucometer. The main challenge in using the PPG method is that the PPG signal characteristics vary depending on physiological conditions and the presence of noise due to motion artifacts that can interfere with the analysis. Therefore, pre-processing with detrend, smooth and 0.5 - 5 Hz cut-off bandpass filters is performed to improve the signal quality. The researcher tried to propose a new method for machine learning-based blood sugar level prediction with time frequency analysis based on PPG signals. Time frequency analysis extracts information from PPG signals using Short Time Fourier Transform (STFT) in the time domain to generate two features, namely instantaneous frequency and spectral entropy. The researcher predicted 36 data out of 67 data with a total of 21900 samples and a sampling frequency of 2175 Hz. The Medium Gaussian SVM and Linear Regression models were trained and tested using the Regression Learner Toolbox. The result showed that the proposed method produced an RMSE value of 20.061 mg/dL in the Medium Gaussian SVM model and 26.67 mg/dL in the Linear Regression model. Based on these results, the Medium Gaussian SVM model had better prediction performance because it produced a lower value than Linear Regression, thus closer to the reference blood sugar level obtained invasively.

Keywords: Time-Frequency Analysis, Blood Sugar, Photoplethysmography, STFT.